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Original Article

MODIFIED ATMOSPHERIC PACKAGING STUDIES OF POINTED GOURD: TREATING WITH DISINFECTANT AND POLYETHYLENE FILM MAINTAINS QUALITY

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ABSTRACT

Fresh mature pointed gourd fruits were harvested and brought to postharvest technology laboratory. They were sorted and healthy fruits were subjected to treatments viz., T_1 (Packaging the produce without pre-packaging material), T_2 (Washing with water + Packaging in LDPE (Low Density Polyethylene film) + CFB), T_3 (Dipping in sodium hypochlorite solution (0.1 ppm) + Packaging in LDPE + CFB boxes). The fruits were examined every week for observing biochemical changes during storage. Maximum storage life (42 days) was observed at 0-3 °C temperature and 85-90 % relative humidity in T_3. Further, T_3 recorded minimum change in Total soluble solids and recorded 4.46 °Brix at the end of the storage. Minimum loss in weight (1.76%) was observed during the study in T_3. Holding time of 8.5 days was also recorded in the same treatment.

KEYWORDS: Pointed Gourd, Pre-Packaging, Sodium Hypochlorite, TSS And Loss In Weight

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INTRODUCTION

Trichosanthes, a genus of family Cucurbitaceae, is an annual or perennial herb grown in tropical Asia. Pointed gourd (*Trichosanthes dioica* Roxb.) is famous vegetable with a common name of parwal and is cultivated in India. It is known as 'King of gourds' because of its greater nutrient content (Saha *et al..*, 2004). Fruit surface wrinkling is more prominent in pointed gourd even with a low water loss (7-8%) from its fresh weight (Guharoy *et al.* 2006). Bulk packaging in gunny bag followed by moistening with water and unfavourable storage conditions of high temperature and low relative humidity tend to rapid shriveling, skin and core yellowing of fruit, development of hard seeds and fungal infestation. Under ordinary storage conditions, pointed gourd has a very short shelf-life of 3-4 days (Koley *et al.,* 2009). Depletion of chlorophyll takes place very fast and it results into yellowing of skin and pulp. Yellow skinned pointed gourds are least accepted by the buyers. Post-harvest dip treatment with 500 mg/l sodium hypochlorite solution at low temperatures removed field heat and eliminated surface pathogens in bitter gourd (Mohammed and Wickham, 1993). However, farmers in the region (Nadia district, West Bengal) were packing the freshly harvested produce in gunny bags and keeping the fruits in

cool store without prior washing. To understand the significance of disinfectant and modified atmospheric packaging by applying LDPE lining the present study on "Modified atmospheric packaging of pointed gourd: treating with disinfectant and polyethylene film" was planned.

MATERIALS AND METHODS

Fresh healthy mature pointed gourd fruits were procured from the farmer's field located near Bidhan Chandra Krishi Viswavidyalaya, Kalyani. The fruits were washed, sorted and selected pre-storage treatments were given. Treatments selected for the experiment were, T_1 (Packaging the produce without pre-packaging material + CFB (Corrugated Fibre Board) boxes)), T_2 (Washing with water + Packaging in LDPE (Low Density Polyethylene film) + CFB), T_3 (Dipping in sodium hypochlorite solution (0.1 ppm) + Packaging in LDPE + CFB boxes). The CFB boxes (5 kg capacity) had length (29 cm), breadth (26 cm) and height (17 cm) with five layers were used for packing the fruits. They were given 4 % ventilation. The lining material used in the experiment is LDPE 100 guage with 0.5% ventilation. The cold store was maintained 0±3 °C with relative humidity 85-90 %. Parameters pertaining to storage life, TSS (Total Soluble Solids), pH, loss in weight and rotting percentage were recorded according to the following methods at weekly interval. Observations were recorded during the storage period for two consecutive years i.e. for 2013 and 2014. Each treatment was replicated five times during the experiments.

The shelf life is a period of time which starts from harvesting and extends up to the start of rotting of fruits and vegetables (Mondal, 2000). Storage life was measured at completely ripened stage or at the limit of acceptability and was expressed in days. The limit of acceptability was determined by fruit or vegetable appearance, visible disease symptoms with or without sign on produce surface, was considered unsuitable for consumption. For recording colour of the pointed gourd fruits, colour chart from Royal Horticultural Society (RHS mini colour chart) was used. To find out the cumulative physiological loss in weight, freshly harvested pointed gourd fruits from each treatment were weighed with the help of digital weighing machine before subjecting them to different treatments. Same fruits were then weighed after 7 days. The loss in weight was derived by subtracting the weight of fruit on the date from the original fresh weight. The percentage loss in weight was calculated by the formula.

$$\text{Physiological loss in weight (PLW)} = \frac{\text{Loss in weight}}{\text{Original fresh weight}} \times 100$$

The total soluble solids (TSS) of were recorded by the help of hand refractometer and the value were corrected to 20° C and expressed in °Brix. pH value was measured directly with the help of systronic pH meter. The number of fruits rotten during the whole storage period was counted in each treatment replication wise. The percentage of rot was worked out by the formula.

$$\text{Rotting percentage} = \frac{\text{Number of rotten fruits}}{\text{Total number of fruits stored}} \times 100$$

Completely Randomized Design was adopted to test significant of treatment means. Pooled data analysis of two selected years was also carried out as suggested by Sahu and Das, 2009.

RESULTS AND DISCUSSIONS

Storage Life

Pointed gourd packed as per treatment T_3 (Dipping in sodium hypochlorite solution (0.1 ppm) + Packaging in LDPE + CFB boxes) had 42 days of storage life. From table 1, fruits with treatments i.e., T_1 [without packaging (simple paper wrapping)], T_2 (Washing with water + Packaging in LDPE + CFB) could be stored for 32.5 and 24 days. During 2012-13 and 2013-14, identical results were observed. It could be corroborated that T_3 had extended storage life of 18 days from T_1 and 9.5 days from T_2. Difference between treatments was significant ($P \leq 0.05$) with $CD_{0.05}$=3.83 (pooled mean). Observations of Koley *et al.* (2009) were also in agreement with the above results who found that pointed gourd could be stored for 10 days at 8-10 °C and 90-95% RH. Extended shelf life of T_3 might be due to cleaning of the fruits with sodium hypochlorite solution and which had controlled rotting caused by microorganisms.

Table 1: Storage Life of Pointed Gourd Subjected to Different Packaging Treatments

Treatments	Storage Life		
	2012-13	2013-14	Pooled Mean
T_1	23	25	24.00
T_2	35	30	32.50
T_3	42	42	42.00
Mean	33.33	32.33	32.83
SEM	0.90	0.95	0.93
CD	4.12	3.25	3.69

TSS

Maximum TSS content was observed in T_1 with 4.60 °Brix on 21st day when compared to T_2 (4.38) and T_3 (4.29) (pooled data with $CD_{0.05}$ = 1.52). Data was homogenous for both years (Hartley F max test). As storage period progressed, total soluble solid contents of pointed gourd increased (Table 2). Packaging the fruits with LDPE had significant effect on fruits when kept in cold storage. Increase in TSS of fruits with LDPE (T_2 and T_3) was negligible when compared to fruits wrapped in paper (T_1). Present results were in line with the findings of Chakraborty *et al.* (1991) who reported delayed and sustained increase in total soluble solids in cool store.

pH

An increase in mean pH during cold storage of pointed with progress of storage life could be noticed from the table 2. Maximum value of pH content (5.83) was noticed in T_1 on 21st day of storage and least value of pH in T_3 (5.49). The increase was significant between the treatments ($P \leq 0.05$). Marginal increase in pH was due to conversion of sugars and enzymatic activity involved in biochemical reactions. A related study was conducted by Koley *et al.* (2009) on pointed gourd was in accordance with present findings.

Table 2: Influence of Different Packaging Treatments on TSS and Ph of Pointed Gourd

TSS (°Brix)								pH					
Days		T_1	T_2	T_3	Mean	SEM	CD	T_1	T_2	T_3	Mean	SEM	CD
0	Y1	3.91	3.91	3.91	3.91	0.01	NS	5.5	5.5	5.5	5.5	0.14	NS
	Y2	4.36	4.36	4.36	4.36	0.03	NS	5.31	5.31	5.31	5.31	0.16	NS
	P	4.14	4.14	4.14	4.14	0.02	NS	5.41	5.41	5.41	5.41	0.15	NS
7	Y1	4.15	3.96	3.95	4.02	0.02	0.08	5.68	5.57	5.5	5.58	0.13	NS
	Y2	4.52	4.38	4.36	4.42	0.41	1.98	5.45	5.34	5.31	5.37	0.15	0.57
	P	4.34	4.17	4.16	4.22	0.22	1.03	5.57	5.46	5.41	5.48	0.14	0.57
14	Y1	4.29	4.05	4.01	4.12	0.32	1.63	5.74	5.62	5.54	5.63	0.01	0.05
	Y2	4.68	4.45	4.48	4.54	0.07	NS	5.67	5.45	5.38	5.5	0.16	NS
	P	4.49	4.25	4.25	4.33	0.20	1.63	5.71	5.54	5.46	5.57	0.09	0.05
21	Y1	4.37	4.08	4.01	4.15	0.24	0.82	5.92	5.65	5.54	5.7	0.13	NS
	Y2	4.82	4.67	4.56	4.68	0.08	NS	5.73	5.48	5.43	5.55	0.02	0.08
	P	4.60	4.38	4.29	4.42	0.16	0.82	5.83	5.57	5.49	5.63	0.08	0.08
28	Y1	-	4.15	4.09	-	0.02	0.08	-	5.69	5.58	-	0.12	0.39
	Y2	-	4.85	4.62	-	0.47	1.69	-	5.59	5.43	-	0.43	1.74
	P	-	4.50	4.36	-	0.25	0.89	-	5.64	5.51	-	-	-
35	Y1	-	4.26	4.13	-	-	-	-	5.71	5.61	-	-	-
	Y2	-	-	4.62	-	-	-	-	-	5.54	-	-	-
	P	-	-	4.38	-	-	-	-	5.71	5.58	-	-	-
42	Y1	-	-	4.22	-	-	-	-	-	5.68	-	-	-
	Y2	-	-	4.7	-	-	-	-	-	5.57	-	-	-
	P	-	-	4.46	-	-	-	-	-	5.63	-	-	-

Y1: 2012-13 and Y2: 2013-14, NS- Non significant P- Pooled mean ; significant differences at$P \leq 0.01$ (LSD test). (-) Indicate treatments in which fruits were already discarded.

Loss in Weight

Weight lost was maximum in T_1 (2.05% pooled mean) followed by T_2 (0.31 %) and T_3 (0.24%) after 2 weeks of storage. From the table 3, pooled mean values suggest that T_3 had least changes in loss in weight when compared to other treatments ($CD_{0.05} = 0.05$). LDPE lining over the produce might be a cause for least loss in weight of T_2 and T_3. Increase in physiological loss in weight could be due to continuation of metabolic processes like respiration and transpiration. Reports from Chakraborty *et al.* 1991 and Sahoo *et al.* (2015) were in parallel with the present study.

Appearance

From the table 3, on 21st day there was a significant difference between treatments ($P \leq 0.05$) with a mean score of 8.20 for T_3 followed by T_2 (7.25) and T_1 (4.65) from initial reading of 8.55. Higher score for appearance for T_3 might be due to maintenance of chlorophyll pigment in the peel tissues. Koley *et al.* 2009 and Sahoo *et al.* (2015) reported analogous scores for pointed gourd during cold storage was in accordance with present readings.

Table 3 Influence of Different Packaging Treatments on Appearance and Weight Loss of Pointed Gourd

Appearance								Loss in weight (%)					
Days		T_1	T_2	T_3	Mean	SEM	CD	T_1	T_2	T_3	Mean	SEM	CD
0	Y1	8.5	8.5	8.5	8.5	0.14	NS	-	-	-	-	-	-
	Y2	8.6	8.6	8.6	8.6	0.16	NS	-	-	-	-	-	-
	P	8.55	8.55	8.55	8.55	0.15	NS	-	-	-	-	-	-
7	Y1	7.1	8.3	8.5	7.97	0.15	0.56	0.286	0.181	0.094	0.19	0.019	0.079
	Y2	7.6	8.5	8.6	8.23	0.17	0.68	0.465	0.106	0.089	0.22	0.02	0.08
	P	7.35	8.40	8.55	8.10	0.16	0.62	0.38	0.14	0.09	0.21	0.02	0.08
14	Y1	6.2	7.9	8.3	7.47	0.16	0.63	0.978	0.198	0.132	0.44	0.03	0.26
	Y2	5.4	8	8.5	8.23	0.18	0.94	1.252	0.121	0.12	0.5	0.05	0.34
	P	5.80	7.95	8.40	7.85	0.17	0.79	1.12	0.16	0.13	0.47	0.04	0.30
21	Y1	4.9	7.1	8.1	6.7	0.26	NS	1.938	0.357	0.265	0.85	0.07	0.43
	Y2	4.4	7.4	8.3	6.69	0.19	NS	2.154	0.263	0.218	0.88	0.04	0.56
	P	4.65	7.25	8.20	6.70	0.23	NS	2.05	0.31	0.24	0.87	0.06	0.50
28	Y1	-	6.1	7.8	-	0.29	-	-	0.859	0.658	0.51	0.06	NS
	Y2	-	5.3	8.1	-	0.21	-	-	0.672	0.783	0.49	0.07	NS
	P	-	5.7	7.95	-	0.25	-	-	-	-	0.50	0.07	NS
35	Y1	-	5.1	7.2	-	-	-	-	1.42	1.224	-	-	-
	Y2	-	-	7.4	-	-	-	-	-	1.068	-	-	-
	P	-	5.1	7.3	-	-	-	-	1.42	1.15	-	-	-
42	Y1	-	-	5.8	-	-	-	-	-	1.892	-	-	-
	Y2	-	-	6.5	-	-	-	-	-	1.634	-	-	-
	P	-	-	6.15	-	-	-	-	-	1.76	-	-	-

1st: 2012-13 and 2nd: 2013-14, NS- Non significant P- Pooled mean; significant differences at$P \leq 0.01$ (LSD test). (-) Indicate treatments in which fruits were already discarded.

Holding Time of Pointed Gourd after Cold Storage

Pointed gourd stored in cold storage at had shelf life of one day after 35 days of storage in T_3 (Table 4). T_3 was best among the treatments. Analogous findings had been given by (Koley *et al.*., 2009).

Rotting

During 2013-14, rotting of fruits in T_1 was highest with 28.4 % on 21st day when compare to T_2 (7.51% on 28th day) and T_3 (3.3 % on 42nd day). Fruits in T_1 had higher rotting percent because of improper packaging and discarded from further study due to poor marketability. Enhancement of storage life till 42nd day in T_3 was due to sodium hypochlorite treatment which might had played a role in keeping out micro-organisms. Our results were in accordance with reports by Sahoo *et al.* (2015) who worked on cold storage of pointed gourd.

Table 4: Influence of Different Packaging Treatments on Rotting Percent and Shelf Life of Pointed Gourd After Cold Storage

Shelf Life of Pointed Gourd After Cold Storage						Rotting (%)			
Days		T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean
7	Y1	1	2	3	2	3.5	-	-	-
	Y2	2	3	4	3	7.8	-	-	-
	P	1.5	2.5	3.5	2.5	5.65	-	-	-
14	Y1	1	2	2	1.667	6.4	0.8	-	3.6
	Y2	1	2	3	2.00	11.9	1.8	-	6.85
	P	1	2	2.5	2.75	9.15	1.3	-	5.225
21	Y1	-	1	2	1.5	14.5	2.5	-	8.5
	Y2	-	1	3	2	28.4	5.9	-	17.15
	P	-	1	2.5	1.75	26.45	4.2	-	15.325
28	Y1	-	-	2	2	-	4.9	-	4.9
	Y2	-	-	2	2	-	10.2	-	10.2
	P	-	-	2	2	-	7.51	-	7.51
35	Y1	-	-	1	1	-	8.5	2.5	5.5
	Y2	-	-	1	1	-	-	0.4	0.4
	P	-	-	1	1	-	8.5	2.45	5.475
42	Y1	-	-	-	-	-	-	4.8	4.8
	Y2	-	-	-	-	-	-	1.8	1.8
	P	-	-	-	-	-	-	3.3	3.3

Y1: 2012-13 and Y2: 2013-14, NS- Non significant P- Pooled mean ; significant differences at$P \leq 0.01$ (LSD test). (-) Indicate treatments in which fruits were already discarded.

Colour

RHS 149A (light green) was recorded initially for both the years i.e., 2012-13 and 2013-14. Colour faded as storage period progressed and ended with RHS 150B (yellowish green) on 21st day in T_1. T_3 had fruits with attractive colour till 35th day with RHS 149A (light yellow colour); might be due to washing of fruits with sodium hypochlorite solution and film packaging with LDPE (0.5% perforation) provided ambient conditions for colour extension. Change of colour to yellowish green might be due to disappearance of chlorophyll pigments from the peel (Table 5, Figure 1). Similar findings were reported by Koley *et al.* (2009), they used a 0-9 scale to describe the colour of fruits. Parallel findings were also given by Kuchi *et al.* (2016) while working on chilli by using RHS colour chart.

Table 5: Colour of Pointed Gourd Subjected to Different Packaging Treatments

Treatments		0		21		42	
		2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
	T_1	RHS 149A	RHS 149A	RHS 150B	RHS 150B	-	-
	T_2	RHS 149A	RHS 149A	RHS 150B	RHS 150B	-	-
	T_3	RHS 149A	RHS 149A	RHS 149A	RHS 149A	RHS 150B	RHS 150B

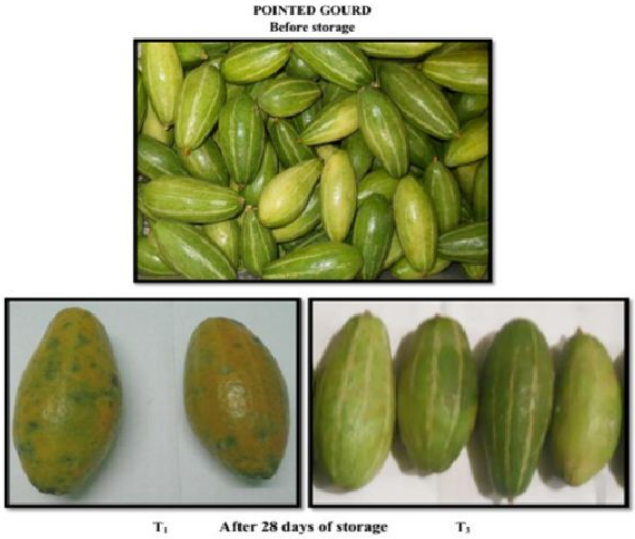

Figure 1: Fruits before and after Storage

CONCLUSIONS

Washing the fruits with sodium hypochlorite and pre-packaging in Low Density Polyethylene film has retained quality parameters such as total soluble solids, pH, colour and appearance. Further, the treatment also extended the storage life of fruits with minimum loss in weight.

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REFERENCES

1. *Mondal, M. F. (2000). Production and storage of fruits (in Bangla). Published by Mrs. Afia Mondal. BAU Campus, pp312.*
2. *Sahu, P. K. & Das, A. K. (2009). Agriculture and Applied Statistics-II. Kalyani Publishers, New Delhi.*
3. *Koley, T. K., Pal, A. R., Pal, R K. & Samuel, D.V.K. (2009). Shelf-life extension in pointed gourd (Trichosanthes dioica Roxb.) by post-harvest application of sodium hypochlorite, potassium metabisulphite and carnauba wax, Journal of Food Science and Technology. 46(6): 581-584.*
4. *Chakraborty, K., Kabir, J., Dhua, R.S. & Ray, S. K. D. (1991). Storage behaviour of pointed gourd under zero energy cool chamber. Horticultural Journal, 4(2):43-47.*
5. *Sahoo, N. R., Bal, L. M., Pal, U. S. & Sahoo, D. (2015). Effect of packaging conditions on quality and shelf-life of fresh pointed gourd (Trichosanthes dioica Roxb.) during storage. Food Packaging and Shelf Life, 5: 56-62.*
6. *Saha, G., Das, S. N. & Khatua, D. (2004). Fruit and vine rot of pointed gourd–etiology, epidemiology and management. J. Mycopathol. Res., 42: 73-81.*
7. *Guharoy, S., Bhattacharyya, S., Mukherjee, S. K., Mandal, N. & Khatua, D C. (2006). Phytophthora melonis associated with fruit and vine rot disease of pointed gourd in India as revealed by RFLP and sequencing of ITS region. J. Phytopathol., 10: 612-615.*

8. *Mohammed, M. & Wickham, L. D. (1993). Extension of bitter gourd storage life through use of reduced temperature and polyethylene wraps. J. Food Qual., 16: 371-382.*

9. *Kuchi, V. S., Chakrabarty, S. & Dhua, R. S. (2016). Influence of Pre-Storage Treatments on Chilli during Cold Storage. Progressive Research, 11: 4: 406–411.*